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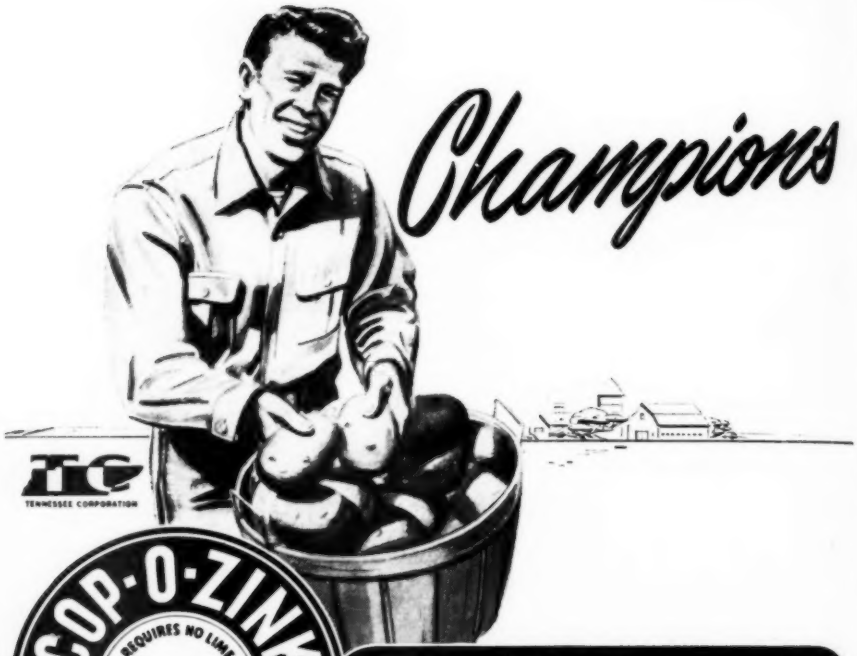

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RING ROT OF POTATOES[1]

Part I of this article was printed in April, 1949.

Part II—Substitutes for boiling water as knife disinfestants in preventing the spread of *Corynebacterium sepedonicum* (Spieck, and Kott.) Skaptason and Burkholder.

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(ACCEPTED FOR PUBLICATION, MAR. 25, 1949)

Early in investigating ring rot of potatoes in Idaho, it became apparent that one of the most acute and immediate problems was to prevent the spread of the causal organism within any given lot of seed while being prepared for planting. It was first believed that treating the cut seed, immediately after cutting, with an adequate seed treating material, would suffice. Experimental evidence disproved this idea. Skaptason (5) offers a possible explanation.

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[1]Published with the approval of the Director of the Idaho Agricultural Experiment Station as Research Paper No. 298.

[2]Associate Plant Pathologist.

The author (3) has presented evidence showing the role played by the cutting knife in spreading the causal organism during the seed cutting process. It seemed apparent therefore that treating the knife with an adequate disinfestant, by a continuous process, would go far in preventing the spread of the organism. To apply such a method to the usual seed cutting equipment used in Idaho presented difficulties. In Idaho, the usual procedure is to cut the seed with knives held in a horizontal cutting platform. The platform lies immediately below a hopper which automatically feeds the tubers to the cutters. To overcome the difficulty, a disc-shaped knife was substituted which rotated constantly through a disinfesting solution. In Colorado, Paschal (2) and his associates, have solved the problem very satisfactorily, by a method which disinfests a double-edged stationary knife.

Any material used as a disinfestant for a disc knife must possess two qualifications. It must be instantaneous in its action, and it must retain its toxic properties in spite of the diluting effect of juices from the potatoes. Boiling water possesses the necessary qualifications. Under some circumstances, however, it is difficult if not impossible to heat the water. A substitute for hot water would therefore be desirable. This paper concerns the reaction of two such materials, one a chlorine containing compound (B-K)[3], the other a thymol containing material (Therapogen).[4]

Experimental Procedure

For each year's test, a power driven disc-shaped knife was used. While in use it revolved through a 3-gallon reservoir containing the bactericide. Russet Burbank potatoes were used in the tests. In 1942 the seed contained 5 per cent infected tubers. The seed was cut in such a manner that the percentage of infected seed pieces was not changed. The originally infected seed pieces were planted with the remainder of the seed.

In 1943, the seed containing 4 per cent infected tubers, was cut in a definite order, equally distributed. Such infected seed pieces were discarded and not planted. In 1944, 1945, 1946 and 1947, the knife was infested by pressing an infected tuber against each side of it, just before turning into bathing solution. Clean tubers were cut as the knife emerged.

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[3]Contains 50 per cent chlorine and is manufactured by Pennsylvania Salt Manufacturing Company.

[4]Contains thymol, sodium brom para phenyl phenate, naphthalene, safrol, thymene and terpineol in a soap solution, alcohol 16 per cent, manufactured by Theo. Meyer Est.

Two materials, based on preliminary tests, were compared with boiling water, as knife disinfestants. They were varying strengths of solution of B. K. and Therapogen. B. K. powder was first used in 1942 in a solution containing 8,000 p.p.m. of chlorine. In 1943 and 1944 solutions containing 5,000 p.p.m. were used and in 1945, the last year it was used, the solution contained 10,000 p.p.m. of chlorine.

Use of Therapogen was first made in 1944 as a 5 per cent solution. Ten per cent solutions were used in subsequent years, with much better results.

Results

B. K. and Therapogen were both capable of disinfesting a rotating knife. However, solutions of the two materials, in these tests, were used but once, and then only while a small number of tubers were beng cut. Accordingly, no knowledge was obtained concerning the length of time over which the material would continue to be effective. That there might be some loss in the materials' effectiveness, with continued use, has been demonstrated by Kreutzer (1) and his associates, in the case of mercuric bichloride. It is common knowledge that chlorine solutions rapidly lose their effectiveness with use.

Data in table 1 show the relative merits of B.K. and Therapogen in comparison with boiling water as a knife disinfestant. Under conditions of the tests, either material was equal to boiling water in preventing spread of the bacteria. Longevity of effectiveness is a merit which any such material must possess in order to be useful. In later tests this quality was ascertained for both materials.

Theophilus and Shaw (6) have given a method for testing the strength of chlorine solutions. This method was used to test the strength of the B.K. solution at certain intervals during the seed cutting process. Table 2 shows how rapidly the strength of the chlorine solution decreases. Beginning with a solution containing 11,579 p.p.m. of chlorine, samples of the solution were tested after cutting ten sacks of potatoes at intervals of one sack. After the tenth sack had been cut the chlorine was reduced to a little more than 50 p.p.m. Since, as is shown in table 1, the chlorine solutions in dilutions of 5,000 p.p.m. were not adequate in disinfesting the knife, it will be noted that after cutting three sacks of potatoes the strength of the bathing solution (3 gallons) had been reduced to 1,325 p.p.m.

Since no chemical test was available with which to test the Therapogen bathing solution, it was therefore tested at certain intervals in the cutting process by exposing the knife to infestation and at the same

TABLE 1.—*Comparative value of B.K. and therapogen as substitutes for boiling water as knife disinfestants, when applied to a rotating disc cutting knife.*

Per cent Ring Rot

Year	Check	Per cent Ring Rot B.K.	Hot H_2O	Therapogen
1942[a]	73.8	(8000 p.p.m.) 2.2		
1943[b]	20.0	(5000 p.p.m.) 5.1	6.1	
1944[c]	75.3	(5000 p.p.m.) 32.7	3.0	(5 per cent) 20.0
1945[c]	94.0	(10,000 p.p.m.) 2.0	0	(10 per cent) 2.0
1946[c]	94.0		4	(10 per cent) 4.0
1947[c]	14.0		6	(10 per cent) 0.0

(a) 1942 - Seed contained 5 per cent infected tubers (infected pieces planted).
(b) 1943 - Seed contained 4 per cent infected tubers (infected pieces discarded).
(c) 1944)
1945) Seed contained no infected tubers (infected tubers held against knife).
1946)
1947)

TABLE 2.—*Rate of reduction in strength of B.K. solution* (10,000 p.p.m) *when used to sterilize a rotary disc seed potato cutting knife.*

Sample	p.p.m. Chlorine	Sample	p.p.m. Chlorine
Original solution before use	11,579	After cutting five sacks	301.5
After cutting one sack	10,670	After cutting six sacks	206.0
After cutting two sacks	6,717.5	After cutting seven sacks	28.0
After cutting three sacks	1,302.5	After cutting eight sacks	24.5
After cutting four sacks	1,109.5	After cutting nine sacks	35.0
		After cutting ten sacks	53.5

time cut a test lot of seed tubers. The latter were planted and the crop examined at harvest for the presence of ring rot bacteria, by the gram stain test. (4) Data in table 3 pertain to this phase of the experiment. It will be noted that after having cut 20 sacks of potatoes, a 10 per cent solution of Therapogen was still capable of disinfesting the knife to the extent that no ring rot appeared in the resulting crop.

TABLE 3.—*Longevity of the effectiveness of a* 10 *per cent solution of therapogen as a knife disinfestant in preventing the spread of Corynebacterium sepedonicum (Spieckermann and Kotthoff) Skaptason and Burkholder.*

Sample	Per cent Disease
Check: Knife not infested clean seed	0
Check: Knife infested, no knife treatment	14
Knife infested. Boiling water treatment	6
Knife infested, 10 per cent therapogen, original solution	0
Knife infested, 10 per cent therapogen after cutting one sack	0
Knife infested, 10 per cent therapogen, after cutting two sacks	0
Knife infested, 10 per cent therapogen, after cutting three sacks	0
Knife infested, 10 per cent therapogen, after cutting four sacks	0
Knife infested, 10 per cen therapogen, after cutting five sacks	0
Knife infested, 10 per cent therapogen, after cutting ten sacks	0
Knife infested, 10 per cent therapogen, after cutting twenty sacks	0
Check, knife not infested clean seed	0

DISCUSSION AND SUMMARY

Boiling water is an excellent material with which to disinfest a rotating disc seed potato cutting knife. However, some operators find it difficult to heat the water. Two substitutes are suggested—B.K., a chlorine containing compound; and Therapogen, a thymol containing solution.

B.K. was found to be inadequate, since it loses its effectiveness too rapidly with use. Under the conditions of the tests herein reported Therapogen proved to be a good substitute. It was equal to boiling water in its ability to disinfest the knife, and remained effective after long use.

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THE EFFECT ON THE YIELD OF POTATOES OF INCORPORATING 2,4-D IN THE REGULAR SPRAY

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(Accepted for publication, Mar. 23, 1949)

Preliminary trials have shown that the growth substance 2,4-D may be successfully incorporated in the potato spray. Bradley and Ellis (1) reported no decrease in yield when as much as .87 pound of actual 2,4-dichlorophenoxyacetic acid was applied in the potato spray for the variety Katahdin. Ennis *et. al.* (2) had previously observed that the Cobbler variety of potato could be treated with 2,4-D without decreasing the yield and in 1948 Thompson and Shuel (4) reported that neither the yield nor cooking quality of Katahdin potatoes was changed by treatment with 2,4-D. The 2,4-D was not applied in the regular insecticide-fungicide spray.

A number of questions relative to the use of this growth substance in future spray programs were then considered: The effect of the growth substance on the tuber which was to be used for seed, the quantity of chemical which could be applied, the stage of growth at which the growth substance should be applied, the compatibility of 2,4-D with several fungicides and the influence of variety on the response to the treatment.

The experiments reported here were designed to give answers to some of these practical questions which the grower must know in order to make use of this weed killer with some assurance of success.

Materials and Methods

All spray material applied for the experiments reported in this paper were applied with a four-row power sprayer at 400 lbs. of pressure per square inch. In the case of the two-row split plots in the variety trial, half of the boom was blocked so that only two rows were being sprayed at one time. Materials were mixed in a separate container and carried on a platform. By this means the sprayer tank was by-passed and contamination of the tank was avoided. This then required only the cleaning of the pump and spray lines.

All plots were laid out on a medium acid muck soil and fertilized with 1000 lbs. of 0-10-20 fertilizer.

Results

Experiment 1 deals with the effect of the chemical 2,4-D on the tuber when used for seed the year following spraying. Tubers of the Katahdin variety from the experiment reported by Bradley and Ellis (1) were planted in five replicated blocks. Only potatoes from the .437 and .875 pound per acre of acid treatments were compared to the untreated plots. The tubers from the replications of each treatment of the 1947 experiments were bulked and then divided for planting. No storage breakdown was observed on the treated potatoes which had been held over from 1947.

TABLE 1.—*Effect of 2,4-D* plant sprays on potatoes for seed*

Treatment	Bushels per Acre No. 1 Size Katahdin Potatoes**
1. Check***	533
2. .437 pound of Acid	511
3. .875 pound of Acid	519
(Yield differences not significant)	

* 2,4-dichlorophenoxyacetic acid in the form of 70 per cent sodium salt of 2,4-D

** Yields from single row 35 hill plots

*** Regular spray made up of basic copper sulfate—4 pounds DDT—2 pounds 50 per cent wettable in 100 gallons of water

The yield of potatoes from these plots show no depression in yield when tubers are used for seed which had been grown on plants sprayed with as much as .875 pound 2,4-D acid per acre.

Experiment 2 deals with rate of application of 2,4-D in the potato spray. Four rates of application and an untreated check were replicated four times. The 2,4-D was applied 38 days after planting and in the third of six copper zinc DDT sprays. Each plot was four rows wide by 100 feet long. Table 2 gives the treatments and bushels per acre taken from 80 feet of the center two rows.

The data in table 2 show no differences in yield when as much as 2.1 pounds of 2,4-D acid equivalent were applied.

Experiment 3 furnishes data on when to spray, the effect on set of tubers and compatibility with several fungicides. The series consisted of six replications of 10 treatments. The plots were four rows wide by 100 feet long.

The treatments consisted of single applications when the potatoes were 3, 8 and 16 inches high, the growth substances included in every spray, and two formulations carrying the equivalent amount of acid in the two sprays applied when the potatoes were 8 and 16 inches tall.

TABLE 2.—*The rate of application of 2,4-D in the spray* and yield of potatoes*

Treatment Pounds of 2,4-D Acid / Acre	Bushels per Acre No. 1 Size Katahdin Potatoes
1. Check	315
2. .35 pound of Acid	340
3. .7 pound of Acid	307
4. 1.44 pounds of Acid	280
5. 2.1 pounds of Acid	325
	N.S.

*6-5-100 Bordeaux + 1 pt. 25 per cent emulsifiable DDT.

The compatibility of several named fungicides with 2,4-D was also compared. These include Parzate, Zerlate, Dithane D-14 and copper-zinc-lime.

The effect of these treatments on set of tubers was determined by digging 20 consecutive hills from each of the larger areas in order to make tuber counts.

Table 3 shows the treatment, yield per acre of No. 1 size tubers and number of tubers per hill for this trial. Eighty foot sections of the two center rows were dug for yield trials.

The yield of potatoes given in table 3 lacks significance at the 5 per cent level. The yields do indicate a trend which should be studied further. It appears that single applications may be made to the potato at any stage of growth and that two applications may be made when sprays are spaced as much as 12 days apart. When potatoes were sprayed with 2,4-D in every spray or with the butyl ester of 2,4-D in two sprays, the foliage was distorted throughout the season and while the yield is not specifically significant, the trend should be considered seriously.

It is further observed from these data that the growth substance 2,4-D is compatible with the fungicides used. Broad leaf weed control was complete and all yields from plots on which an organic fungicide was substituted for the copper zinc spray were as high or higher than the check plot.

Six spray applications were made during the season. Fungicides and insecticides were applied each time. The 2,4-D was applied as indicated in the table. The dates of application and height of the plants were: June 30—3 inches; July 12—8 inches; July 24—16 inches; and fungicide DDT sprays were applied July 17, August 10 and August 24.

It had previously been suggested that spraying the potato plant with 2,4-D might increase the number of tubers per hill. These data indicate that all treatments were higher than the check but the differences

under the conditions of this experiment were not quite significant at the 5 per cent level. There is a definite trend toward increasing the set and further study will be necessary.

TABLE 3.—*Yield of potatoes treated at different stages of growth with 2,4-D and with different fungicides in the spray*

Insecticide Fungicide Spray	(Treatment) 2,4-D Applied	Height of Plants in Inches	Bushels per Acre	Average No. of Tubers per Hill
1. Base Spray*	.52 pound acid equivalent as sodium salt of 2,4-D	3	489	8.2
2. " "	"	8	469	7.6
3. " "	"	16	470	7.6
4. " "	"	all sprays	390	9.0
5. " "	"	8 and 16	450	9.0
6. " "	.52 pound acid equivalent as butyl ester	8 and 16	384	9.0
7. Parzate	.52 pound acid equivalent as sodium salt of 2,4-D	8 and 16	462	7.3
8. Zerlate	"	8 and 16	520	7.3
9. Dithane D-14	"	8 and 16	478	9.3
10. Base Spray	"		430	7.2
			N.S.	N.S.

* 6 pounds Copper Sulfate
5 pounds Hydrated Lime
1 pound Saf-n-led
2 pounds DDT

Experiment 4 deals with varietal response to treatment with 2,4-D. Six varieties—Katahdin, Chippewa, Sebago, Russet Rural, Bliss Triumph and Irish Cobbler—were planted in 80 hill 2-row split plots. These potatoes were sprayed with the copper-zinc-lime DDT spray on June 26, June 30, July 10, July 12, July 17, August 9 and August 24. On July 12 and July 17 the 2,4-D was included in the spray. Soon after the application on July 12 a rain of 1.03 inches fell and although the plan did not call for two sprays of 2,4-D in rapid succession, the treatment was repeated. Table 4 lists the six varieties of potatoes and gives the percentage of depression in yield from the two applications of 2,4-D.

The data show that there is a difference in the response of the different varieties to the treatment. The Russet Rural variety apparently had the least capacity to recover from the effect of the treatment. The commonly grown varieties were of about the same order in relation

TABLE 4.—*Effect on yield of two treatments of .52 pound of 2,4-D acid per acre applied in a five day interval on six varieties of potatoes*

Variety	Yield in Bushels per Acre*		Per cent Loss in Yield from Treatment
	Two Treatments .52 Pound 2,4-D Acid per Acre at 5-Day Interval	No. 2,4-D**	
1. Katahdin	430	623	31
2. Chippewa	290	424	32
3. Sebago	405	521	22
4. Russet Rural	224	593	62
5. Triumph	496	696	29
6. Cobbler	442	611	28

*No. 1 size.

**The effect of treatment is significant at the 1 per cent level and the varietal effect is significant at the 5 per cent level.

to effect on the yield. It will be necessary to survey all new varieties to determine this relationship.

DISCUSSION

The use of 2,4-D in the regular potato spray shows promise but should not be substituted for cultivation at the present time. It appears that there are no ill effects from the spray carried over in tubers to be used for seed. However, certified seed potato growers should not use 2,4-D unless approved by the certification agency since the effect may be confused with disease symptoms. The data here presented indicate that as much as 2.1 pounds of 2,4-D acid equivalent may be added at one time without depressing the yields.

It has also been observed from this data that the size of the plant may not be so important as the interval between sprays, and we may suggest from this that more than one spray would be possible each season provided a sufficient period of time elapses between treatments for the plant to recover. Potato plants are affected by the 2,4-D but the ability of the plant to recover determines the usefulness of the treatment.

The common fungicides were tested and since weed kill was observed and no depression in yield resulted, we may assume that the 2,4-D in the form of the sodium salt is compatible with these fungicides.

The data also indicate that the yield of potato may be depressed when applications of 2,4-D are applied at 5 day intervals. The minimum time lapse will need to be determined in order that the treatment may be safe for the grower to use.

Skin color changes were photographically recorded but actual color

measurements have not been made. Observations similar to Fults and Schaal (3) were made on Bliss Triumph tubers. The skin color was greatly intensified on the treated potatoes. On Russet Rural potatoes the brown color of the normal Russet potato became yellow-brown with treatment. No differences could be detected in the white skinned varieties.

Summary

1. Potatoes treated with as much as .875 pound of 2,4-D acid equivalent per acre as sodium salt did not break down in storage.

2. These potatoes, when used for seed, were not affected by the former treatment. Seed growers are warned not to use 2,4-D since the reaction on the plant might be confused with disease.

3. Amounts as high as 2.1 pounds of acid equivalent may be made in single applications without depressing the yield of Katahdin potatoes.

4. Present data do not indicate that 2,4-D treatment will consistently increase the set of tubers on muck soil.

5. When making single applications, the size of the plant when treatment is made does not affect the yield.

6. 2,4-D is compatible with some of the common fungicides used in potato spraying, *i. e.* Basic Copper, Bordeaux mixture, Parzate, Zerlate and Dithane D-14.

7. Decrease in yield of the potato crop resulted when two sprays were applied at 5-day intervals, the Russet Rural variety being affected more severely than other varieties.

8. Visible changes in skin color result from a spray treatment of .52 pound of 2,4-D acid. Skin color in Triumph was intensified.

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SUMMARY OF PAPERS PRESENTED AT THE POTATO CONFERENCE HELD AT THE EASTERN REGIONAL RESEARCH LABORATORY OCTOBER 19-21, 1948

(Continued from May Issue)

Problems of the Potato Chip Industry

The discussion was based primarily on the problems of the Wise Potato Chip Company, which are closely similar to those of the other 400 potato chip manufacturers.

The National Potato Chip Institute appropriated $5,000.00 last year for research on the problems of the chip manufacturer, but not enough time had elapsed for this program to make real progress.

Of all the known varieties (estimated to be more than 300), the Russet appears best for chip production. A suitable substitute for the Russet is desirable, however, because of its low yield per acre and susceptibility to disease. Katahdins and the new variety, Kennebec, give higher yields per acre, but chips made from them have little taste. There is some reason to believe that the Russet will not disappear entirely from the Eastern States; the Western States can use Cobblers.

The tendency to develop new varieties for table stock; *i.e.*, with preference given to appearance and cooking quality, will not necessarily lead to varieties suitable for chip manufacture. Potatoes of low moisture content are needed for chip production to obtain maximum purchase value, maximum weight yield of chips, and low absorption of oil.

Not only are quality and variety important, but size also plays a role in the production of potato chips. Even though U. S. No. 1 is used, it is sometimes necessary to cut the larger tubers (thus increasing labor costs) to facilitate packing and decrease breakage with the automatic packaging machines.

It is necessary to keep the sugar content at a low level to produce the light golden brown chip acceptable to the consumer. The chemical composition has a direct bearing on the curing and flavor. Enzymic action and temperature determine the curing time when the initial temperature and reducing sugar level are known. Considerable information has already been obtained on the relationship between starch content, temperature and curing time; in some instances it is possible to predict suitable temperatures and curing periods.

Diseases caused by bacteria and viruses in the field and on storage are troublesome. Although every lot of potatoes is carefully inspected, the evils and problems of disease cannot be entirely eliminated. Even

if field diseases could be completely eliminated by judicious buying, it still would be necessary to combat disease in storage. As soon as disease is discovered in potatoes intended for chip manufacture, the disease is identified and the storage temperature is adjusted to retard spreading of the disease. Some bacteria apparently cause an increase in the sugar content. Sometimes the temperature can be adjusted to increase respiration and transpiration rate and the removal of the unwanted reducing sugar. The reducing sugar is undesirable because it causes the formation of hydroxymethylfurfural and subsequent darkening of the chip. Each lot of potatoes presents its own peculiar disease problems, and the chip manufacturer must strive constantly to keep disease at a minimum. Since the potatoes are obtained from Florida to Maine, the problem is national rather than local.

The chip manufacturer must also maintain an interest in the development and use of insecticides. Benzene hexachloride is a classic example of the disastrous results that may be caused by the injudicious use of new insecticides. The chip manufacturer must guard against the purchase of potatoes that have been sprayed with materials having an adverse effect upon flavor and taste.

The former practice of selecting potatoes principally by appearance has yielded to dependence on various chemical tests. From the original potato to finished products, the results of chemical tests are carefully recorded. The laboratory regularly tests potatoes in storage to determine whether the temperature should be adjusted to minimize sugar formation. When the concentration of reducing sugar is brought to a minimum, the proper frying temperature is determined in the laboratory. The laboratory also tests the frying oil, cellophane, fuel oil, cooking oils, packaging materials, and antioxidants.

Flavor and organoleptic methods are no longer used exclusively to determine the quality of chips. These methods are supplemented by chemical tests for aldehydes. Peroxide formation is used as an indication of incipient rancidity.

It is hoped eventually to solve all or most of the problems associated with chip manufacture and to continue providing the consumer with a tasty, wholesome, nutritious, and attractively packaged food—a food that has already become an important item in the diet and budget of Mr. and Mrs. America.—PAUL A. ZANDER., *Wise Potato Chip Co., Berwick, Pa.*

What Are the Present Needs in Potato Research?

Summing up the present needs of potato research would be an easy task if the only factor involved were making a list of all the things

we might think up for the laboratories to work on. But since time is essential and priority important, it is necessary to select that which seems likely to give the broadest kind of results in the light of the present difficulties of the industry. A research program is of necessity a long-range affair and expediency should have little part in it. Nevertheless, we should put "first things first" if we expect to begin a long-delayed improvement.

Our recommendations should recognize, it seems to me, the excellent work already done and being done by the Potato Advisory Committee established under the Research and Marketing Act. That Committee has repeatedly stressed that in research top priority be given to projects for expanding uses *other than as human food in fresh form.* At the same time the importance of some projects in production and marketing has not been ignored. That Committee continues to devote painstaking attention to our needs in relation to the over-all administration of the Act.

Production Research

On the production side, the breeding program merits continued emphasis, since from it will come, as they have in the past, the productive, disease-resistant and higher quality varieties to replace present ones that inevitably deteriorate under cultivation. Their endurance under modern high-speed harvesting methods may well be a quality to seek, and table quality will assume a larger importance as we learn more about this intangible factor from the results of the cooking test research. High starch content may or may not be desirable in table varieties, depending on what we learn about mealiness *versus* moist-flesh in different forms of cooking. It must be kept in mind that the Government already possesses a large and well-staffed extension service whose work it is to carry out the results of research to growers and make such results immediately available through demonstration.

Marketing Research

Recent surveys tell us that combination grocery stores sell about 37 per cent of all food eaten in the United States. It is said that such stores sell about 42 per cent of the produce consumed. This leaves the remainder of food sold to such distribution agencies as the government, military buyers, specialty stores such as fruit and vegetable markets, and institutions including restaurants, hotels, colleges and schools, factory lunch rooms, railroad dining cars, clubs and hospitals. It appears, therefore, that the institutional market may well account for nearly

one-half of our fresh sales. It is fortunate that we have with us my well-qualified colleague, Col. Paul Logan, who can discuss that phase of our market and its needs out of a very broad and well-rounded experience. I am going to leave that segment of the discussion entirely to him.

Retail Distribution Research

In retail distribution to the consumer, studies by the Government are already under way and reports from them are becoming available. Most of them have been of two types. In the first type, studies of buying behavior are made under existing conditions based upon observation and historical data. The second type consists of studies dealing with preferences, attitudes and opinions. It would seem advisable to conduct certain kinds of surveys under a third type, studies designed to evaluate preferences under controlled experiments. Observation of buying behavior alone does not assure that consumers were given a chance to buy the goods or services they wanted most, therefore it seems desirable to test them by actual offerings of goods of controlled quality, quantity and price.

The Department of Agriculture is already engaged, through contract with the organization I represent, in a nation-wide project for training retailers in better merchandising of fresh fruits and vegetables, including potatoes. In slightly less than a year we have trained nearly 7,000 retailers in over 40 cities in modern methods of preparation, display, care, pricing and merchandising, and the program is expanding. Average increases of approximately 30 per cent in the volume of fruit and vegetable business are reported from stores whose personnel have attended this carefully-planned, one-day course. We, in turn, are learning much about this important work in our chain of distribution—we too are learning to "think retail."

Future studies of consumer preference should include consumer types of package, more facts on preferences as applied to a larger group of cities, metropolitan *versus* rural or semi-rural communities; industrial *versus* non-industrial towns; buying habits of different income groups, and perhaps climatic and seasonal variations in consumption.

Since we have seen some indications that rough handling injures our product and reduces consumer acceptance, should we concentrate exclusively on better handling all along the line or is our principal package itself to blame? Could package research develop for us a container offering a better degree of protection than the 100-lb. bag affords, at the same time costing no more?

Inelastic Demand

A word about the phrase, "inelastic demand." We have been hearing this phrase applied to potatoes for a great many years now, and it seems time to examine it more closely. Do the economists who use it mean that the public will eat only about so many potatoes anyway, and nothing can be done about it? Or do they mean that, unlike certain other food items, such as perhaps citrus fruits or lettuce, there does not seem to exist the possibility of expanding consumption by one, two or three hundred per cent? The former would be a defeatist conclusion which a sales-minded industry would and should reject. I am inclined to believe it is not what "inelastic demand" is supposed to mean, since consumer surveys do not support such a proposal. In fact in its report on potato preferences among household consumers, the USDA says,

> "In a market of good quality, when prices shift upward, about 12 per cent reported that they buy less. When prices go down, 20 per cent reported they buy more."

And again,

> "While a great bulk of the consumers reported they buy a constant quantity of potatoes under most circumstances, there is a peripheral group around this core of buyers who are apparently sensitive to market conditions and who report that they expand and contract their volume of purchases as price and quality vary."

We can reasonably assume, I think, that the consumers have been affected in their preferences to some degree by our shortcomings in grading, packaging, advertising and merchandising in competition with other foods, and that we can, as an industry, bring about at least some increase in sales and consumption if we have the will to do it.

Transportation Important

Several excellent studies in railway and truck transportation, refrigeration in transit, care in terminal markets and in retail stores and losses in transportation from wholesalers to retailers are already under way. They may well be continued and expanded. Results of refrigeration tests on potatoes in transit inspire the thought that perhaps we need still another committee, to see that the results of research already completed are taken out of the files and acted upon by both growers and shippers, thus turning findings into practices. This may offer fertile ground for progress.

Utilization

We have had here an imposing array of information about progress in turning our low grades into food, industrial uses and feed. Coming along as it does with the accomplished fact of marketing agreements already established in 12 states, and available for use in controlling crop movement, this offers perhaps the most hopeful sign of improvement in that portion of our crop (and the major portion) which the consumer buys and pays us for. It offers at the same time perhaps our most effective argument in convincing the public that we seek self-help rather than a public dole.

Food Uses

Food outlets such as chips, dehydrates, canned and frozen potatoes and potato mixes are fairly well established and need only such continued improvement in processes and raw material development as will enable them to expand in volume and use. Flour and meal, while now manufactured in large volume, rest at present on an insecure foreign demand and need to be studied as products for which a domestic market of unknown potential must be found. This is both a laboratory and sales problem, to improve and lower the cost on the one hand, and to broaden its sales on the other. The industry needs to turn its attention to this question without delay.

Industrial Outlets

Potatoes as a source of alcohol present many problems, which have been ably presented. It may well be that their place in motor fuel manufacture, among other agricultural crops and wastes, will presently be found, unless our oil resources are larger than geologists say. They present a problem in transportation which seems capable of solution only if fuel prices rise or larger yields of high-starch potatoes find an economical place in our agriculture.

Other end-products of potato fermentation in the chemical field offer a continuing backlog of work for the chemist. The work in starch production is being watched by a capable and widespread industry, but should nevertheless have our continued support

Livestock Feed

It is in the field of livestock feed development that the layman is tempted to offer the greatest amount of free advice to the scientist, and to make the strongest plea for accelerated effort. Feeding of culls and low grades in fresh form to livestock is a well established and extensive

practice, but it labors under definite limitations of bulk, weight and perishability, which have restricted its expansion in spite of what has been almost free distribution by the Government. Dehydrated potato feed and feed supplements derived from potatoes seem to offer one of the broadest outlets within the realm of immediate possibility.

The value of dehydrated potatoes as a stock feed is well established by experiment station tests in many states. It has been generally proven that they are nearly as valuable as corn for feeding most classes of livestock. Commercial feed manufacturers are aware of this, but because of their large-scale operations, and the fact that they must conform for rather long periods of time to published formulas, they cannot use dried potatoes until they have been guaranteed an ample and continuing supply.

It is true that feed supplies are on the increase as grain production catches up with world-wide demand. But rising transportation costs make grain feeds cost more in many areas where both potatoes and livestock are produced. A survey in the North Platte Valley has revealed that in that area there is a potential market for feeding lambs alone, for at least 15 thousand tons of dried potato feed annually. This is 2½ times the available local supply of dried cull potatoes, and also does not include another large outlet for cattle and hog feeding there. Similar surveys elsewhere would reveal even greater possibilities.

It seems therefore that we should undertake to determine what areas could use dried potatoes to advantage in or near the points where the culls, low grades or surplusses exist. Cheaper methods of drying, particularly in small-scale units, should be engineered. Perhaps this can be expedited through contracts with high-class, experienced engineering firms to perform this research. At the same time we should work with feed manufacturers toward developing both the market and the larger scale facilities necessary to supply it. In both activities we will need to locate such facilities so that transportation and handling costs can be held to a minimum.

Still another article of feed needs attention. Artificial feed supplements such as blackstrap molasses, beet molasses and low grade corn syrup are now in common use in large volume. Blackstrap currently costs over $30.00 per ton in tanker lots at east coast ports; much more inland. Why not develop a simple pressure-hydrolysis method of making a crude, dilute feed sweetener from cull potatoes? We should examine the practicability of doing this in small, low-cost installations near our grading warehouses in producing areas. We should also find out whether high concentration or artificial preservation is really nec-

essary, or whether such a product can be used up by local feeders promptly in more dilute form. Also, whether such a product contains additional nutrients or vitamins making it more valuable than as a sweetener alone.

There is ample evidence that such a product can be made. One leading distillery reports the development of an acid-hydrolized continuous process for converting grain mashes first to sugars and then to alcohol. It is even reported that hogs have been fattened from feeds sweetened with molasses made from sawdust. If such a product could be locally made from cull potatoes and then used to supplement feeds containing locally dried potatoes also, the advantages seem obvious.

In conclusion it may be repeated that if the recommendations given seem top-heavy on the side of utilization, it is so because of our double-barrelled problem of selling the best and processing the rest. If ways can be found to make a withholding of low grades more attractive, one-half of our problem of better grading will be solved. And it seems apparent from surveys so far conducted that better grading will help to turn the declining curve of consumption upward.—Kris Bemis, *United Fresh Fruit and Vegetable Association, Washington 9, D. C.*

What the Restaurant Operator Looks for in Potatoes

I am very happy to have had the privilege of listening to the wealth of useful information which has been presented at this conference, and I am grateful for the opportunity of presenting a few thoughts about the potato needs of the Public Feeding Industry. Mr. Bemis in his talk on the first day of your meeting keynoted the relative importance of the problems which confront potato producers when he said "we grow potatoes primarily as a food crop for use by consumers principally in fresh form," and "sales for non-food uses and for livestock feed are a form of safety valve for drawing off—first our low grades, and then our surplusses."

Since 1910 there has been a steady decline in the consumption of both white and sweet potatoes until in 1947, it was only 69 per cent of what it was at that time. Grain product consumption declined 26 per cent during the same period. Meat consumption had declined 14 per cent when in 1937 The American Meat Institute began a vigorous educational program upon the nutritional value and "food-satisfaction" of meat consumption. During the following ten years it moved from a minus 14 per cent on the down curve of consumption to a plus 5 per cent. In the meantime dairy products, sugar and sirups, fats and oils, eggs, fruits and vegetables—all showed substantial increases—the last

reaching a consumption rate of almost 160 per cent above the base period.

The decline in potato consumption is a great pity from a world food viewpoint because, outside of the rice eating areas, it is a fundamental food, abundant in quantity, economical in use, and excellent in nutrition. There are, of course, many contributing causes to this decline, most of which have been discussed at this meeting.

One important cause is the fallacious and unchecked opinion that potatoes are a fattening food. This belief has caused untold thousands of women to decrease or discontinue their use of potatoes. Let me illustrate the effect of this—as it goes on today—and as it will continue until a vigorous educational program changes the belief.

Between 1946 and 1948, over a two-year period, a most exhaustive nutritional and food preference study was made of 2182 people by Penn State College. Half of the subjects were men and half women. They were divided into 5-age groups (17-21) (22-26) (27-36) (37-46) (47-56). Their diets were self-selected. The amount of different kinds of food consumed was carefully recorded for each group. The foods were classified as (milk) (meat) (eggs) (dried legumes) (leafy green and yellow vegetables) (citrus fruits and tomatoes) (bread and cereals) (sugar) (fats) and (potatoes).

Here are the results on potatoes. The men ate 2 1/10 pounds per week and there were no noticeable difference in consumption between the male age groups. The women ate 1 2/10 pounds per week—which is only 57 per cent as much as the men ate—although in the total of food, the women ate 87 per cent as much as men. But there was a great difference in the consumption rate among the female age groups. The youngest and oldest of the groups ate the most. The 27-36 year group ate the least, and the 37-46 next to least. Yet these are the years when women are raising their children through their most important period of adolescence, and the attitude of the wife and mother toward potatoes is undoubtedly reflected in the consumption rate of the family.

But I have come here to discuss the needs of the Public Feeding Industry for improved potato service. This industry constitutes a major market for potatoes, and is one which should be given careful and continuous attention by potato men.

According to OPA statistics there are about 524,000 public feeding places in the United States, which annually provide some forty billion meals for our people. This is approximately a quarter of all the food consumed in America. Sixty-three million customers sit at the tables

and counters of our restaurants every day—and what they find there—good and poor—has an influence upon the home consumption rate of the same foods. If they find really wonderful hash brown or baked potatoes in the restaurant, they want to have the same at home. If they find gummy or watery mashed potatoes in the restaurant, they lay-off mashed potatoes at home.

The restaurant man for the past three years has been constantly bedeviled by increasing food and labor costs. In a well-run restaurant the food costs should be held at around 42 per cent of the sales dollar. When the cost recently rose to over 50 per cent there was no alternative but to raise menu prices—or cut portions. In a good operation the labor cost in a restaurant should be about 28 per cent of each sales dollar. In most areas it is now about 35 per cent and in the far west it is 45. This condition causes the restaurant manager to be very receptive to any sound and practical suggestion which will serve to reduce his labor cost.

Within these two cost areas—one on food, and the other on labor, in my opinion, lies a real opportunity to increase the consumption rate of potatoes by restaurants which, under proper conditions, will lower both food and labor costs and, at the same time, improve the standard of food service.

But the potato distribution will have to undergo considerable change if the improvements I have mentioned are to be realized. First, and most important I think, is a thorough understanding by all potato and restaurant men that there is no such thing as an "all purpose" potato; that while potatoes having certain physical characteristics may be used for a number of cooked dishes, they usually are especially good for one or two; and that selling or buying potatoes under the mere title of "Potatoes" is as absurdly inadequate as would be the purchase or sale of wheat or apples or automobiles under the empirical name of those products. Secondly, these same people must come to a realization that a variety name does not guarantee a constant uniformity of product. The difference between the same potato variety grown in Florida and New Jersey, in north and south Maine, on acid and non-acid soil is too well known to need further repetition. Thirdly, we must realize that all varieties change their physical characteristics as storage life progresses. And finally, that potatoes having certain characteristics are good for specific purposes, regardless of variety or area of growth. The first question to be answered and which needs research is where and how can these potato characteristics best be commercially determined. We all know that a potato with a specific

gravity of 1.09 or better is high in starch and therefore apt to be a good baker or masher, while one that is below 1.07 is soggy and apt to be good for salad work. We don't know as much as we should about the character of the starch or other constituents which cause stuffing, gray discolorization, dark spotting, etc. We all know that potatoes having a sugar content much over 3 per cent are not satisfactory for deep frying or chip manufacturing, and that the amount of reducing sugar and nitrogenous matter present is of greater importance than the total amount of sugar present. How can we measure these things so that the measurement will benefit the consumer? It seems obvious that the work must be done by the agency which moves them into retail or consumption channels.

Canners do not find it difficult to separate green peas on the basis of starch content by brine flotation. Potato men could do the same. Potato chip manufacturers almost universally are having their stocks measured for sugar content and, when necessary, have them conditioned for use by reducing the sugar content through 70° storage. Certainly the restaurant man who wants to serve perfect French fried potatoes would be willing and glad to pay a premium for a guarantee that potatoes purchased for that purpose would always be satisfactory.

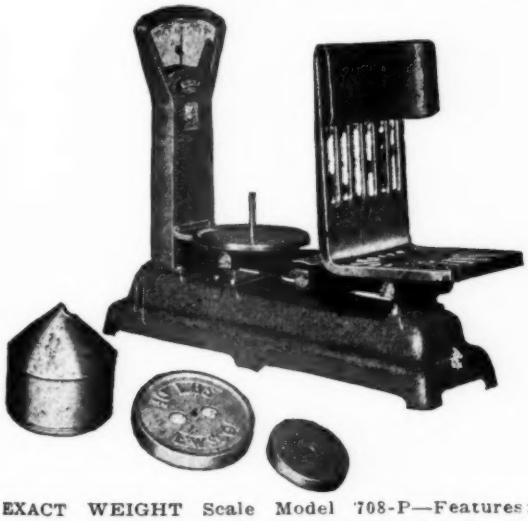
Potato consumption would increase substantially in restaurants if every potato dish served could be of superb quality. Of course, a poor cook can spoil any kind of food, but restaurants staffed with poor cooks don't remain restaurants—or at least they never join the select 22 per cent which feeds 80 per cent of all the meals served by the entire industry.

Potatoes are a low cost item. If by excellence in service the consumption rate could be increased by one ounce per meal, the other costly item of poultry, fish or meat could be decreased by at least one-half ounce. A one-half ounce of 60 cent food being replaced by one ounce of 6 cent food would drop the food cost by 1½c. On the basis of potatoes being served at 2/3 of the meals, the one ounce increase would amount to over 2½ million pounds per day or about 960 million pounds per year. It is my firm belief that this can be done if the potato distributors will separate, package, and define their deliveries, and the consumers will use the potato properly. But the benefit would go far beyond the tonnage increase in restaurant use. It would create a home demand for better and more potatoes. This, together with a vigorous educational program, about the non-fattening quality of potatoes would start the per capita consumption curve back up.

The second phase is that of lowering the labor cost. Right now

Round Pegs in Square Holes....

There are many weighing operations and in turn many types of scales for various operations. The wrong unit in the wrong place is a round peg in a square hole. Such an application is inefficient, time consuming, high in cost and unprofitable. For example the use of a catch weight scale in a pre-determined weight application will waste enough potatoes alone to pay for the right unit in a matter of weeks where volume is involved. EXACT WEIGHT Scales are pre-determined weight units. Pre-determined weight is our business . . . in fact our only business. We do not sell just scales. Rather we strive to reduce costs, control quality and diversify operations for efficient production that is profitable to the user of EXACT WEIGHT Scales. Makes a survey of your own. You will be surprised what a few changes will mean in reducing your costs. If your problem is pre-determined weight write us for full details.



EXACT WEIGHT Scale Model 708-P—Features: Special commodity holder, tilted and equipped with guard to hold bags . . . dial 6" wide, 1 lb. overweight and underweight by 4 oz. graduations and in direct line of operator's vision . . . nonbreakable dial glass . . . short platter fall for speed of operation . . . Capacity to 15 pounds.

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restaurant men find it difficult to hire scullery people at from 80c to $1.00 per hour. In spite of that, there are less than 50 per cent who own mechanical peelers—because of the initial cost of the machine. This of course applies wholly to the 78 per cent group—not to the 22 per cent group. Mechanical friction peeling results in 18 to 20 per cent loss in smooth and 27 to 30 per cent loss in rough potatoes. Hand peeling losses are as high as 40 per cent. The potato is probably handled four to six times between the receiving platform and the stove. I don't happen to know of any time-motion study which has been made on the storing and make-ready work but what with peeling, cleaning utensils and machines, trash disposals, *etc.*, it must constitute a cost at least half as much as the cost of the potatoes. Now, most of that cost can be eliminated by the commercial peeling of potatoes. It is being successfully done now in several places, and within the next few years it will probably become standard procedure throughout all metropolitan areas.

When a restaurant man can buy peeled potatoes he gets a product which is 100 per cent usable, eliminates all the labor incident to peeling and to the cleaning that goes with it. He saves considerable storage space and increases work area space by the absence of peeling activities. If commercial peeling can be done for restaurants, it can also be done for the housewife. Steam pressure or caustic peeling will save from a half to 3/4 of present peeling losses. Dips are now available which will prevent discoloration.

We need more information about the physical characteristics of potatoes as related to cooking quality. We need information as to whether the pH of cooking water affects the starch or other constituents. We need research to develop speedy and sure methods of measuring potato characteristics and one that, at a reasonable cost, can be used by distributors in their present warehouses.

With this research accomplished, breeding programs could be pointed toward development of desired qualities and elimination of undesired ones. With this information we can make the *per capita* consumption climb a ladder. Without it we can keep on looking down the declining consumption path—or else, as was suggested the other day, import more Irishmen to eat potatoes.—PAUL P. LOGAN. *National Restaurant Association, Chicago, Ill.*

SECTIONAL NOTES

ALABAMA

Alabama, after trials and much anxiety, has harvested and marketed one of the best Irish potato crops in several years. The general cash

return was also the highest for our growers than for many years. This was because of the price paid to farmers for their potatoes. Our growers sold all their crop from a price range of $2.60 to $4.00 for No. 1 grade potatoes. Commercials, No. 1 size but out of No. 1 grade due to non-rot defects, sold for 15 cents less than the U. S. No. 1 grade. It has been estimated that our 10,000 acres in Baldwin County yielded nearly 100 bags of potatoes per acre, average. With the above prices it is easy to understand why we are pleased with returns. Escambia County, (Atmore area) did not have such a good yield because of weather and blight conditions but most of the growers made a fair profit with some few taking losses.

Just before harvest we had approximately 11 inches of rain in a week's time. Since the first few days of shipments did not carry well the ability of the crop to withstand shipment caused much concern. After a few days of dry weather the balance of the crop was mature and was carried to market in wonderful shape. This contributed to the steady and increasing demand for our potatoes at increasing price late in our season. Even though we had the worse dose of Late Blight in several years, there seemed to be no evidence that it caused potatoes to rot in transit or in the fields. It is apparent that our Triumphs and Sebagoes have been able to resist this threat when grown under our conditions.

It is generally accepted that we must control blight from now on not only because of yield but to be able to market in an orderly manner. Copper dusts and Carbamate dusts and sprays (Dithane and Parzate) applied in a definite program paid well this season. It is apparent that late but fairly uniform applications of fungicides prevented the destructive spread of Late Blight until our crop had matured.

For the first time our Dealers, shippers, and growers, really like the Government program. In general, they cooperated with it nearly 100 per cent and probably will in future seasons. The Government purchase of No. 1B size at $2.00 per hundred loaded in cars really did the trick with us. The No. 1 size sold well and the Government worried with the B's. Remember that our growers are used to selling B size for 50 cents per hundred or less and to get $1.44 per hundred helped tremendously. They say this program was less expensive for the Government also. I believe as long as our growers feel that they can plant a fair number of acres and will have some security against prices that will ruin them, they will cooperate with the Government program in every way possible. This program will do a lot to help our growers become better potato farmers. FRANK GARRETT.

Indiana

Practically all our commercial potato acreage will be planted by the first week in June and our growers are somewhat worried regarding what the Government is going to do. If I remember correctly, approximately 136 acres of potatoes were shipped from Indiana (a deficiency state) to other states and our consumers are not very much in favor of such tactics another year. The intentions to plant will amount to approximately 27,500 acres and unless we have exceptionally high yields we are going to be in need of a lot of potatoes which will naturally keep the wheels rolling on both trucks and railroads.

A few flea beetles are prevalent but they are being controlled in practically all the large fields. The weather has been ideal and so far no disease troubles have appeared. W. B. Ward.

Maine

Indications are that approximately 97 per cent of Aroostook County Farmers are staying within the acreage allotment. Maine's allotment is 141,300 acres and Aroostook's share is 130,700. Although the County P. and M.A. Committee had a great many requests for increased acreage they were, of course, unable to grant many of these requests, and indications are that there will be a very high participation.

Aroostook got off on an early planting start and for awhile was about two weeks ahead of ordinary conditions. Because of somewhat cold weather and rains in the middle of the month the tempo of work slowed down. Growing conditions indicate that the County is now about one week ahead of average. Farmers, in general, are using more fertilizer and are planting more closely in the row. The average application this year is nearly 2000 pounds of 8-12-16 or equivalent per acre. There seems to be a swing to single strength fertilizers but it is not easy to explain why.

Even though no potatoes have emerged to date, there will be many showing within a day or so. Dr. E. S. Schultz, of the U.S.D.A. has found late blight in some discarded potatoes.

The Extension service is publishing a new Bulletin on the use of DDT. Recommendations are that DDT be applied when one-half of the plants in a field have emerged. Table stock growers who started spraying by the 10th of June can expect control of flee beetles, aphids and also maximum yields if four sprays are applied between the 10th of June and the 15th of August.

The Marketing Agreement for Maine has completed its first year

with appreciably good results according to most potato handlers. VERNE C. BEVERLY.

MISSOURI

The potato crop looks exceptionally well in the Jackson-Clay-Ray district. We have had ideal weather conditions for potatoes with plenty of rain and cool temperatures. The set is perfect and practically every field is showing a good stand.

Late blight developed in several fields during the first part of June. Growers are quite concerned about this disease and are attempting to get the fields dusted between showers. Airplane dusting will be resorted to starting the week of the 5th. Several fields are showing damage from standing water since excessive rain has fallen. At this time (June 4) prospects look good but this picture could change very quickly with continued heavy rains and temperatures favorable for the development of late blight. BEN F. VANCE.

NEW JERSEY

The prolonged dry period which has lasted for 24 days to the present time (June 18) has not only injured early potatoes on the lighter soils but also some of the early varieties on heavier soils. Katahdins and other late varieties are in full bloom and have not been injured as much as have the early varieties. The late-maturing varieties will probably yield a light crop unless adequate rain comes immediately. No estimate of the loss can be determined accurately at present. However, it must be appreciable.

Several growers have purchased irrigation systems during the past two weeks and are irrigating their potatoes continuously. Those growers, who had irrigation systems, have made two to three applications and their potatoes are growing satisfactorily. Irrigation will undoubtedly be of great value this year.

Growers are seriously considering the adoption of a marketing agreement and local meetings have been held throughout the state. We believe that such an agreement, if properly set up and administered, can result in higher prices for high quality potatoes, if the farmers will keep the poor grades off the market and not sell their high quality potatoes too rapidly. JOHN C. CAMPBELL.

NEW YORK

New York growers had about completed their planting operations by the 1st of June, about 10 days ahead of schedule. It is apparent that

our acreage is almost in line with the acreage goals, but at this time it is obvious that we had underplanted rather than overplanted.

Growers in general, have been quite concerned with the Brannan program which they don't like because it puts the emphasis on the non-commercial grower and takes support from the commercial acreage which we like to refer to as the efficient producer. News that this program probably will not be put into effect this year was very welcome.

New York growers are anxious to see the present Support Program given a trial. Potatoes have sold under 60 per cent of Parity only three years in the last 20 years and those years were disastrous as far as potato growers were concerned. Certainly 60 per cent Parity support discourages over planting and speculation.

We think that the present program would help bring supplies in line with demand especially if Marketing Agreements or some other regulation will keep the low grades off the market. H. J. EVANS.

NORTH CAROLINA

Harvesting the new crop of Irish potatoes in eastern North Carolina began the second week in May. The first harvested potatoes began rolling to the market on the 12th of May. At present, practically all of the eastern North Carolina potato growers are in the process of harvesting their crop. The earlier section (around Beaufort) will complete their harvesting operations about the time the later areas (Elizabeth City and Camden) begin digging.

It is expected that an average to above average yield will be obtained from the early crop, as growing conditions have been favorable throughout the season. Growers in most of the areas have been keeping their plants thoroughly dusted with copper fungicides to prevent the development of late blight and to prevent a repetition of the epiphytotic of late blight which occurred during the latter part of the 1948 growing season.

A Field Day was held at The Tidewater Test Farm at Plymouth, N. C., on the 23rd of May. State Commissioner of Agriculture, L. Y. Ballentine, addressed the growers, and the potato research program at the Test Farm was explained by Dr. R. W. Cummings, Associate Director of the North Carolina Experiment Station. A field tour of the experimental plots was conducted by members of the Experiment Station Research Staff. Work that is being conducted on fertilization, varieties, disease control and cultural practices was explained by the staff members during the tour. A larger number of growers were present than was anticipated. This was especially gratifying, since potatoes

were being harvested in many sections and in other areas many growers were preparing to harvest their potato crop.

The 1949 potato acreage for North Carolina is at the quota allotted by the Department of Agriculture. The growers have adhered strictly to their allotted acreages and in no case have there been reports of any grower overplanting his allotment. M. E. GARDNER.

SOUTH CAROLINA

More than 90 per cent of the potatoes from the Charleston-Beaufort area were harvested by the 1st of June. Although not a record-breaking crop it has been one of the best. The average yields are reported running from approximately 100 to as high as 185 bags per acre for the entire farms. Our harvesting operations started about as early as on any previous date and the market demand in addition to good weather speeded the crop to market in record time. The quality has generally been good with some late blight causing trouble in poorly dusted fields. Wireworms, too, are plentiful in a few fields and a trace of soft rot has been observed during the past few days. "Wind cracks" have been reported bad in the few reds planted this year. Viruses were also entirely too evident in the reds which came mostly from North Dakota. More than ½ the crop sold at above $4.00 per bag as washed potatoes, and all potatoes were sold at $3.50 per bag or more. Unwashed potatoes sold for 25-50 cents per bag less and the demand was not so good. Washed Sebagoes have been in demand and sold in northern terminals for as much or more than the Western Longwhites. Trucks moved more of the crop than at any time in the past.

Our growers are now considering the purchasing of more washing machines, and the planting of more Sebagoes next year. This combination apparently makes it possible for our growers to compete favorably with our much-talked-of competition—"California longwhites."

Kennebec has performed well in the Station Trials for several seasons and it is hoped that seed will be available for extensive grower and shipper trials next year. W. C. BARNES.

SOUTH DAKOTA

Early-planted potatoes in South Dakota are up and show a good stand. There will be approximately a 12 per cent reduction in the potato acreage in this area and we expect about 6500 acres to be entered for certification. The acreage of all potatoes in South Dakota will be about 18,000 this year which will be the smallest acreage since 1884.

Field inspection will start about the 15th of June and Dr. C. E. Rosenquist from the University of Nebraska will work on field inspection with Dr. L. T. Richardson from the University of Ottawa, Canada, who is coming to South Dakota State College as Assistant Pathologist with the Experiment Station.

Not much comment has been heard concerning the support program for the 1949 crop but growers believe the purchase of only Number 2 potatoes is a step in the right direction.

The appointment of members of the Marketing Committee has been announced and they will meet after the 1st of July to organize for the year.

Shipments of the 1948 crop under commercial grade were restricted by the Marketing Order. A total of 929,002 cwt. was inspected during the 1948 crop season of which 58.4 per cent were U. S. No. 1 quality, 7.7 per cent were U. S. commercial grade, and 15.8 per cent were U. S. No. 2 grade.

Certified seed potato shipments amounted to 13.8 per cent of the crop in 1948. JOHN NOONAN.

PROVINCE OF CANADA

As your paper goes to press, Prince Edward Island is just completing the marketing of last year's crop. The surplus of approximately 500 carloads has been purchased by the Agricultural Price Support Board.

During the last week of May our domestic market, becoming depleted with potatoes, rose sharply.

Planting in Prince Edward Island as of the 1st of June was 25 per cent completed and the acreage will possibly be down at least 10 per cent of last year.

Again this year all growers are required to plant certified seed or even better seed if obtainable. Also the usual attention is being paid to seed plots with tuber unit planting and a considerable number of seed plots are using seed which has been eye-indexed by the local Inspection Service under the supervision of Mr. S. G. Peppin. E. D. REID.

AMERICAN POTATO YEARBOOK

The 1949 edition of the AMERICAN POTATO YEARBOOK is off the press. The new volume is considerably larger than last year's issue and contains eighty-four pages of interesting and vital information to the potato grower, the potato dealer and shipper, the potato research specialist and all those with an interest in the potato industry. It is

edited by John C. Campbell, Rutgers University College of Agriculture and is endorsed by the Potato Association of America.

Of special significance is the feature article by Dr. F. J. Stevenson of the United States Department of Agriculture on past, present, and future varieties of potatoes. The article is illustrated with tables. There is also an up-to-date list of more than 100 references to potato culture in the United States. Other interesting items include rules and regulations affecting the shipment of seed potatoes, support schedules, a map indicating the leading potato areas in this country, a list of leading United States and Canadian associations engaged in the improvement of the potato industry together with the names of United States and Canadian seed certification officials. The YEARBOOK also gives information on how and where to secure helpful brochures and leaflets covering many phases of the potato industry.

The book contains much statistical information of value. There are tabulations by states of both seed and table stock production as well as statistics on Canadian and world potato production. Other important features include an illustrated chart indicating the utilization of white potatoes, a list of periodicals of interest to the potato industry, a chart giving the amount of seed required and a classified directory of business concerns serving growers and dealers.

Copies of the YEARBOOK may be secured from the American Potato Yearbook, Business Office, 289 Fourth Avenue, New York 10, N. Y. An individual copy sells for $2.00.